All about Welding Nozzles

Tips are offered for determining the best nozzle design for a given application, along with maintenance advice that can measureably impact quality and productivity

BY DAVID BELLAMY AND JEFF WELLS

Fig. 1 — A welder is shown using the gas metal arc process. Selecting the proper shape, style, and material of nozzle for a given welding application can help minimize downtime, reduce costs, and improve weld quality and productivity.

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Like other gas shielded metal arc (GMAW) gun consumables, nozzles are often an overlooked component in the welding operation — Fig. 1.

However, knowing how to select the best nozzle for a given welding application can have a measurable impact on the quality, productivity, and overall cost of the welding operation. That's because the nozzle is responsible for directing the shielding gas to the weld pool and protecting it from contamination. Without proper gas flow, the weldment is prone to a number of problems, including excessive spatter and porosity that can ultimately lead to downtime for rework. Plus, using the wrong nozzle for an application may cause overheating that leads to premature consumable failure.

For these reasons, it is important to select the right shape and style of nozzle, as well as the right material for each application. Also, knowing how to store and handle nozzles properly can go a long way in helping keep the welding operation up and running. Consider these tips.

What Are the Best Nozzle Shapes, Styles, and Materials?

When selecting a nozzle, the goal is to find one that provides the best joint access for the application and allows for the proper gas flow to the weld pool. Keep in mind that nozzles with smaller inside diameters may be more prone to collect spatter, so it is better to use a nozzle with the largest possible inside diameter to ensure greater gas flow.

Nozzles are available in several shapes, including straight, bottleneck, and short or long tapers. Straight nozzles typically have larger inside diameters (e.g., ¾ in.), but the joint access is not as good. Bottleneck nozzles can improve this situation, particularly for automated welding applications. A common inside diameter for a bottleneck nozzle is ½ in.

Semiautomatic applications often use short and long taper nozzles, although the former are also common in automated welding. Note, that long taper nozzles typically have smaller inside diameters and thus may collect spatter more readily. When possible, use a short taper nozzle to minimize this problem.

Each nozzle shape is usually available in standard and heavy-duty styles, and in slip-on or thread-on varieties. Heavy-duty nozzles have thicker walls, as well as thicker insulators, and are designed for use in high-current applications ranging

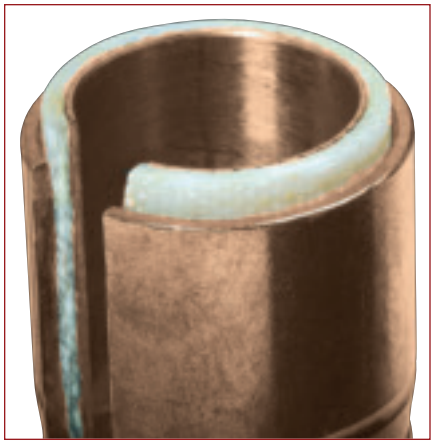

Fig. 2 — Nozzles that feature a fiberglass insulator and brass insert, as shown in this cut-away, can help extend the life of the consumable. The brass insert, in particular, helps maintain the inner diameter of the nozzle to assure proper shielding gas flow.

Fig. 3 — Examples of nozzle spatter buildup. Checking the nozzle periodically for spatter buildup and proper cleaning can extend the life of the consumable. Applying an antispatter product can also help prevent spatter from building up.

from 400 to 600 A. Due to their heavier construction, these nozzles resist heat better than standard varieties. Standard nozzles tend to have thinner walls and are better for 100- to 300-A applications. Slip-on nozzles, as the name implies, simply slip onto the front end of the GMAW gun. These nozzles are quite common in the industry, compared to thread-on nozzles that must be twisted to install, and they offer the advantage of being able to be replaced more quickly.

A note of caution when installing slip-on nozzles, be certain that they are securely connected to the retaining head. Doing so helps prevent shielding gas leaks that could lead to poor weld quality.

Nozzles are typically available in brass or copper, although chrome-plated nozzles are also available. Brass nozzles tend to resist spatter well and are good for lower-current applications (100 to 300 A), whereas copper nozzles are better for high-current applications (above 300 A) and for those with longer arc-on time.

Water-cooled nozzles are also available for high-current applications. These circulate coolant around the nozzles and tend to be much more expensive.

From the Nozzle to Contact Tip

The relationship between the nozzle and contact tip can have a significant impact on weld quality and should be selected carefully for each application. Generally, welding operators maintain a recessed or extended contact-tip-to-nozzle relationship. A recessed contact tip offers better gas coverage, but it also shortens the electrode extension. As a result, this contact-tip-to-nozzle relationship offers less accessibility to the joint. Conversely, an extended contact-tip-to-nozzle relationship allows the welding operator greater access into confined areas or joints. In this scenario, however, the shielding gas coverage may not be as good as compared to a recessed contact tip. Typically, an extended contact tip is used in automated applications, but it can also be used in the semiautomatic process. In these applications, there is an increased chance of the welding operator touching the contact tip to the workpiece because of the extension, which could damage the consumable and also cause poor weld quality.

The welding operator will need to weigh these advantages and disadvantages to determine whether a recessed or extended contact tip will provide the better welding performance for the job.

Tips for Making Your Nozzles Last Longer and Perform Better

As with any front-end consumable, handling, storing, and maintaining the nozzle properly helps ensure good welding performance and longevity. Selecting higher-quality nozzles can help, too.

Look for nozzles that have a smooth surface finish and edges, as these resist spatter buildup compared to nozzles that have an uneven surface or burrs on the edges. Heftier nozzles are more desirable than lighter or thinner ones since they tend to resist heat better. Also, consider purchasing nozzles that feature a brass insert, which helps maintain the inner diameter of the nozzle, and prevents the nozzle from rocking and wearing prematurely. The addition of a high-temperature fiberglass insulator can also help extend nozzle life — Fig. 2. Finally, look for heavy-duty crimping on the nozzle. The crimping holds the layers together and is an indication that the nozzle will last longer.

The goal is to find a nozzle that provides the best joint access for the application and allows for proper gas flow to the weld pool.

When storing nozzles, keep them in their original packaging, usually a small plastic bag. Removing them from that packaging and placing them in a bin can lead to scratches or dents that allow spatter to adhere and will ultimately shorten the life of the nozzle. Use gloves when handling nozzles or replacing nozzles to prevent dirt, oil, or other contaminants from adhering to them and inadvertently entering the weld pool.

Periodically inspect the nozzle for spatter buildup and clean it using the tool recommended by the manufacturer as needed and/or consider using an antispatter compound to protect against spatter — Fig. 3. To apply the antispatter, dip approximately the front inch and a half of the nozzle into the antispatter compound. Avoid submerging the nozzle in the compound, as it can saturate the fiberglass insulator inside and cause it to fail prematurely.

Finally, never use the nozzle to chip away spatter. It can dent or misshape the nozzle, requiring it to be replaced.

As with any front-end consumable, nozzles play an important role in maintaining good weld quality and can have a measurable impact on productivity and costs, too. Take the time to select the right one for each application then maintain it properly. Doing so can minimize downtime and keep your welding operation running smoother.♦